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SIX DOLLARS

Electronic Business

Distribution: The story behind the franchise fracas

Graphics boards: Adding up an add-in market

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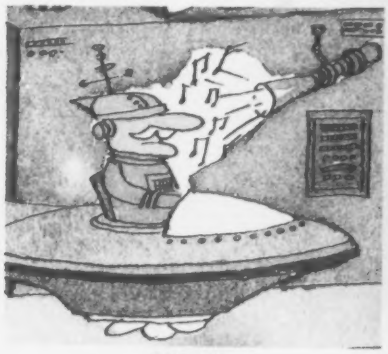
University Parks

Electronic Business

VOL. 13, NO. 6 — MARCH 15, 1987

THE BUSINESS MAGAZINE FOR THE ELECTRONICS INDUSTRY



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Cover photo/Tim Davis

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Modest growth projected in 1987 for electronic components

Our in-house forecasting unit anticipates a definite improvement. Other researchers agree

Look for moderate growth this year in industrial production of electronic components (SIC 367), including semiconductors. As business picks up slowly in most electronic end-equipment markets, component manufacturers will be assured of continued recovery this year. By year-end, according to Cahners Economics, component production in the United States will have reached the same level of activity as the second quarter of 1984.

Semiconductor production accounts for the largest part of SIC 367. As early as January, Andrew A. Procassini, president of the Semiconductor Industry Association, was saying that the "apparent improvement in business conditions during December" boded well for the new year. At that time, Procassini also noted that U.S. semiconductor shipments for 1986 had reached an estimated $8.5 billion, up 5% from $8.1 billion in 1985, but 27% below 1984's record $11.6 billion. Although the SIA's figures measure consumption, rather than production, they spell out a better environment for U.S. chip makers.

Other independent market researchers tend to support this projection. Most conservative is In-Stat Inc. The Scottsdale, Ariz., semiconductor market specialist figures that growth will be sluggish. In late January, it was forecasting 5.1% growth to $8.86 billion in North American semiconductor sales for 1987. Worldwide, In-Stat said, sales would increase 9.3% to $28.93 billion.

Dataquest was more bullish. Last time we looked, the firm was projecting an 18% increase in worldwide consumption of semiconductors this year and 12% increase in the United States — with most of the growth occurring in the second half of the year. Over the 1986-1991 period, Dataquest says U.S. semiconductor consumption is likely to climb at a 12% compound annual growth rate. The firm attributes the anticipated rise in orders to increased growth in Southeast Asian markets, including South Korea and the People's Republic of China; the trend toward establishing local manufacturing facilities around the world; and the emerging need for orchestrated research and development programs involving industry, such as the Semiconductor Research Corp. and the proposed Sematech program.

Moderate growth is also forecast for components other than semiconductors. The market for switches, for example, which has historically accounted for 1.3% of all electronic component shipments, is expected to reach $773 million in sales at the producer level by 1990, according to Marketdata Enterprises, an industrial research firm in Williston Park, N.Y. That represents a 5.5% annual growth rate (including inflation) from an estimated $601 million in sales last year.

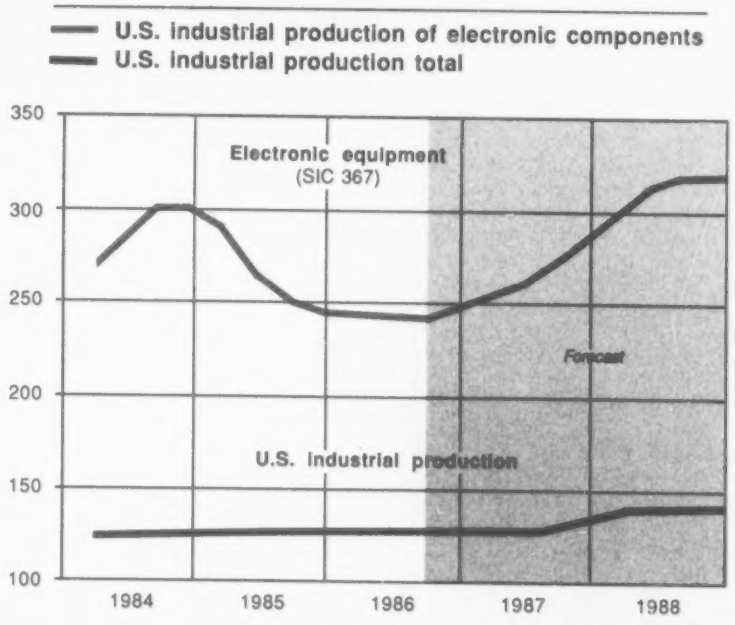
In monitors, which also fall under SIC code 367 for electronic components and accessories, look for an average annual increase of 14.8% in nonconsumer applications to $8.66 billion through 1993, according to International Planning Information Inc. in Redwood City, Calif. Unit volume, at the same time, will grow only 10.2% annually to 42.3 million units in 1993.

Innovations in surface mount technology are also expected to generate some additional demand. The New York City market research firm of Frost & Sullivan Inc., for example, sees a major expansion in surface-mounted devices (SMDs) in Europe — from $657 million in sales last year to $1.9 billion in 1991. During that time frame, SMDs, which today account for less than a tenth of all electronic components in Europe, will climb to nearly a fifth.

AL FURST

Electronic components

Industrial production indexes, 1977 = 100



Historical data: Federal Reserve Board
Forecast: Cahners Economics

New orders

Manufacturers received $11.6 billion in new orders during the third quarter of 1986, down 1.7% from the prior quarter. This was a strong performance for the summer quarter, when business is traditionally sluggish. In fact, after seasonal adjustment, orders would have increased 16.5%, their sharpest improvement since early 1985. Despite the industry's second-half gains, weak order rates earlier in 1986 are responsible for an expected loss of 13.9% to $46.6 billion for the year. But rising export sales, a large number of new product introductions and an anticipated turnaround in investment by U.S. businesses should bring a return to growth this year. Orders are expected to rebound 11.5% in 1987 and nearly 20% in 1988.

Shipments

Although orders began to show signs of improvement last summer, shipments continued to struggle along just as they had earlier in the year. In the third quarter, producers of computers and office machines shipped $12.0 billion worth of equipment, down slightly from $12.3 billion in the second quarter. Annually, shipments are expected to reach $48.1 billion, 13.3% below 1985's level. Conditions currently look favorable for a return to moderate growth in the computer industry. If orders sustain their present uptrend, then shipments will improve gradually during most of the current year, achieving an overall annual growth rate of 7.7%. Shipments are expected to increase 15% in 1988.

Unfilled orders

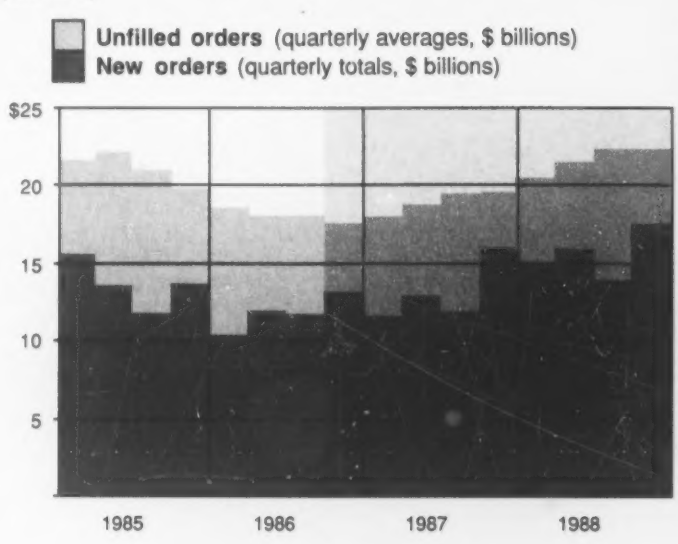
After declining almost without interruption for more than two years, manufacturers' order backlogs began to stabilize in late 1986. They averaged $18.0 billion in the third quarter, down only slightly from the previous quarter's $18.1 billion. Early reports for the fourth quarter indicate that backlogs will post another modest decrease, but are expected to reverse direction in early 1987, expanding gradually as the year unfolds. Backlogs are expected to post an overall gain of 4.9% this year (up from a 14.7% loss in 1986) and then swell 14.2% more in 1988.

Inventory-to-shipment ratio

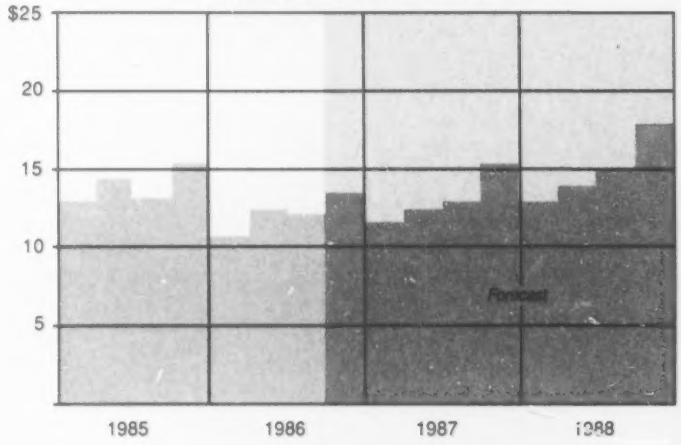
The ratio of computer manufacturers' inventories to shipments fell to 2.55 in the third quarter from an average of 2.77 in the previous quarter. This drop brought the ratio about back to its level at the end of 1984, before the industry entered into a steep downslide. This implies that inventories have finally returned to the desired balance with shipments and that the recent process of inventory liquidation is now virtually complete. Look for manufacturers to maintain tight inventory strategies over the next several quarters, holding the I/S ratio within a normal expansionary range of 2.55 to 2.75.

Office and computing equipment

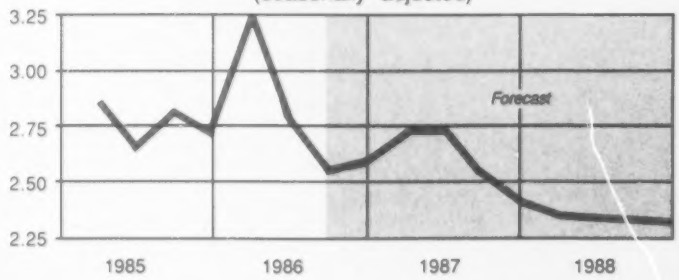
(SIC 357)



Office and computing equipment: Shipments
(quarterly totals, $ billions)



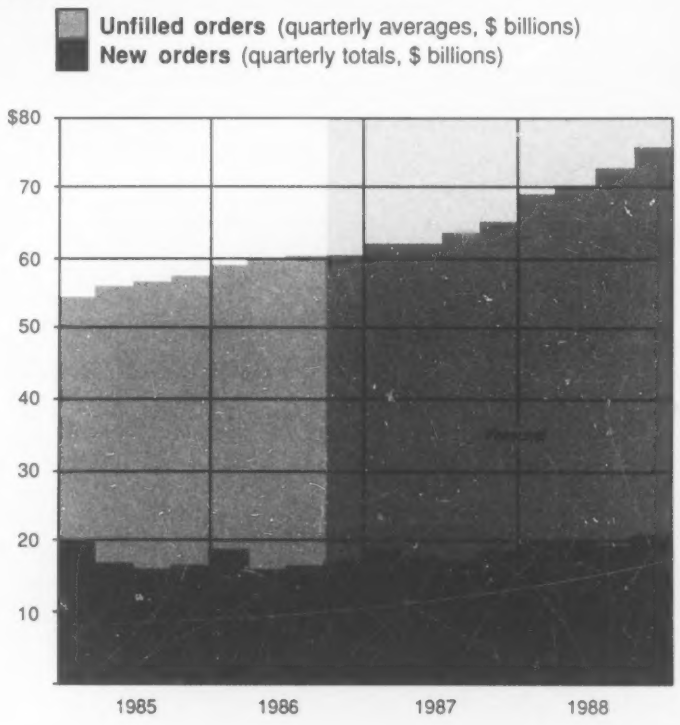
Office and computing equipment: Inventory-to-shipment ratio
(seasonally adjusted)



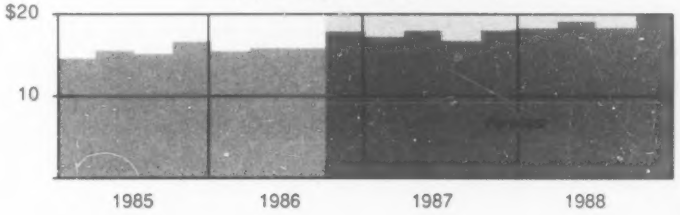
Historical data: U.S. Department of Commerce
Forecast: Cahners Economics

Communication equipment

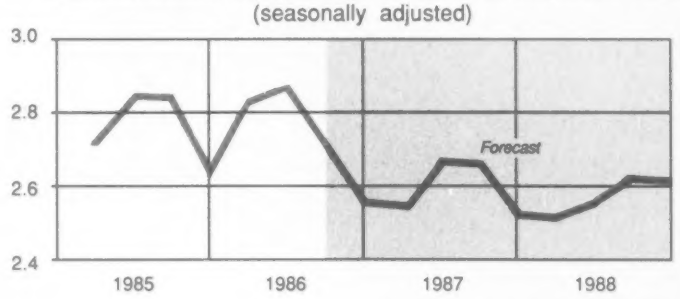
(SIC 366)



Communication equipment: Shipments
(quarterly totals, $ billions)



Communication equipment: Inventory-to-shipment ratio
(seasonally adjusted)



Historical data: U.S. Department of Commerce
Forecast: Cahners Economics

New orders

Communication equipment manufacturers received $16.6 billion in new orders during the third quarter, up from a total of $15.9 billion in the previous quarter. Improvements were reported within both the defense and nondefense segments of the industry. This rise in activity extended into the fourth quarter, but was not large enough to prevent 1986 from showing a shortfall of 1.2%. Prospects for growth in 1987 and 1988 are somewhat brighter. Recent cutbacks in military procurement authority will restrain the defense-equipment market, but a pickup in capital spending by U.S. businesses is expected to revitalize the larger nondefense segment. This will push industry-wide orders up 4.9% to $72.0 billion this year and 11.0% more in 1988.

Shipments

Although orders for communication equipment were extremely disappointing in early 1986, high backlogs (especially for defense-related systems) enabled manufacturers to maintain a fairly steady rate of shipments. In the third quarter, manufacturers shipped $16.2 billion worth of equipment, a level which was equal to the prior quarter and up 7.3% from the third quarter of 1985. When year-end figures become available, 1986 should show an overall gain of 5.3% to $65.8 billion. Look for the growth rate to improve only slightly to 6.2% in 1987, before accelerating to 9.3% in 1988.

Unfilled orders

The communication equipment industry's backlogs increased 0.7% to $60.6 billion in the third quarter. But even though backlogs continued to expand, their growth rate was much less rapid than it had been previously. In fact, for 1986 as a whole, we expect to see an increase of just 6.8%, down sharply from the 19.4% gain recorded in 1985. Projections for modest growth in both orders and shipments this year, mean that backlogs are likely to show another single-digit gain, probably about 5.5%. The growth rate is expected to jump to 14% in 1988, as business conditions improve.

Inventory-to-shipment ratio

The ratio of manufacturers' inventories to shipments averaged 2.72 in the third quarter, down sharply from a reading of 2.87 in the previous quarter. This decrease reflects a continuation of tight inventory controls on the part of manufacturers. Inventories increased only 2% in the third quarter, while shipments surged ahead more than 8% on a seasonally-adjusted basis during the same period. The ratio is expected to edge slightly lower in the fourth quarter, as inventory depletion continues, before stabilizing in a 2.55 to 2.65 range in early- to mid-1987.

It may be NCR, not IBM, in the store of the future

With nearly half the market, NCR are the initials with clout in the point-of-sale terminals industry

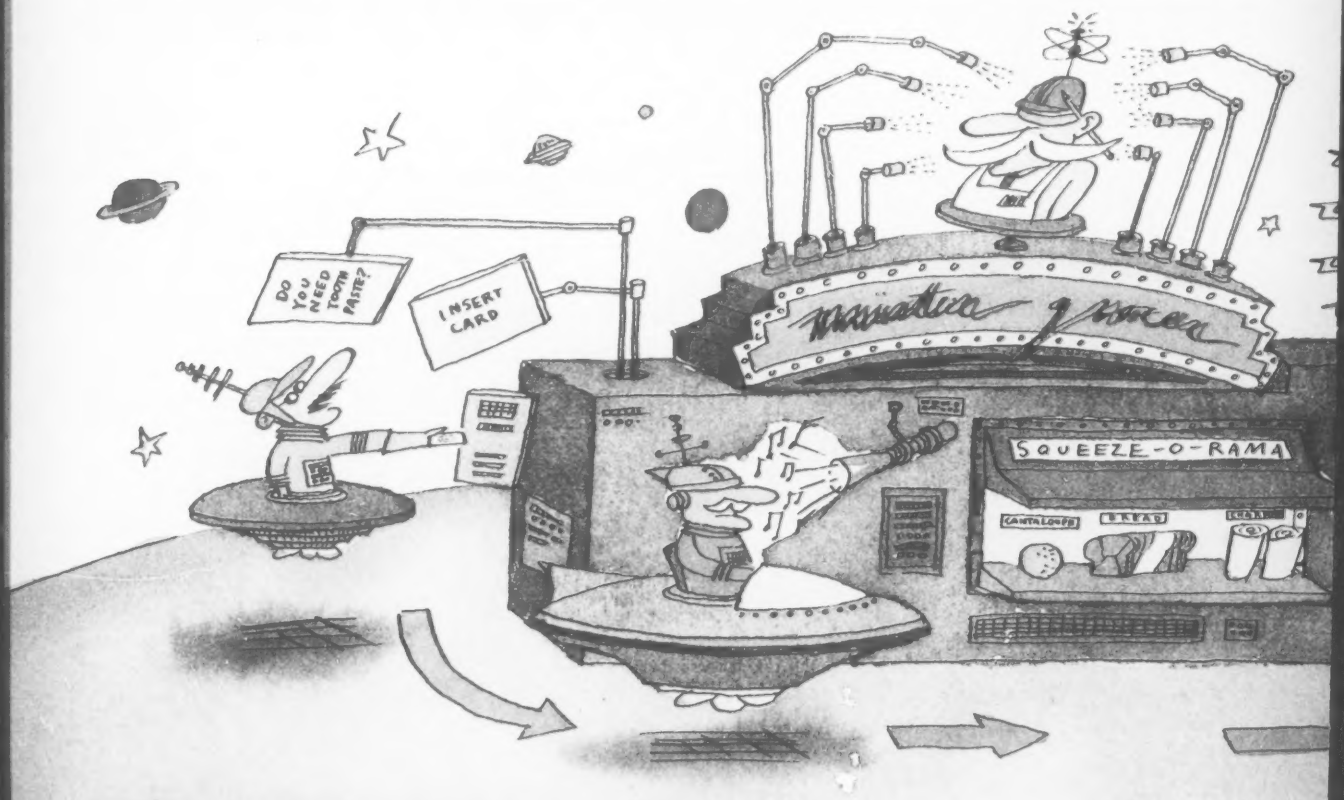
Old axioms don't always hold true. IBM does not always wait for a market to hit a billion dollars before it jumps into it. And the industry giant does not always win the lion's share of those markets it targets. IBM competes in the retail point-of-sale (POS) terminals market, estimated to reach $500 million this year, according to International Data Corp. (IDC), a market research firm in Framingham, Mass. And despite its efforts, Big Blue has been unable to chip away at NCR Corp.'s commanding lead in that market.

The retail store of the future — which might include 20 lane grocery stores with intelligent, electronic cash registers that do everything from keeping track of how many bananas are on the shelves to querying the consumers' bank account — may look slightly different than today's neighborhood fruit stand or local bookstore. But, more than likely, the equipment running those hypermarkets will bear the same three initials that they do today.

IBM does not mean all things to all people. In the POS terminals market, the Armonk, N.Y., company runs a distant second to NCR. According to IDC, IBM has cornered approximately 23% of the market while NCR has maintained the 47% share it has held historically. IBM's dominance in mainframes, which run the corporations that run retail stores, has had little effect on the company's ranking in the POS terminals market. In the retail industry, especially at the store level, says Steven Milunovich, an analyst with First Boston Corp., in New York City, customers trust NCR. "And it's harder to take share away at the terminal, or store, level than at the minicomputer, or departmental, level," says Milunovich.

NCR is well aware of IBM's lofty position in many retail stores' corporate headquarters. "We grudgingly have to admit IBM owns the lion's share of the back office," says Carl J. Steinmetz, vice president of NCR's retail systems division. To counteract any advantage that might give IBM, says Steinmetz, NCR has taken the same open systems approach, includ-

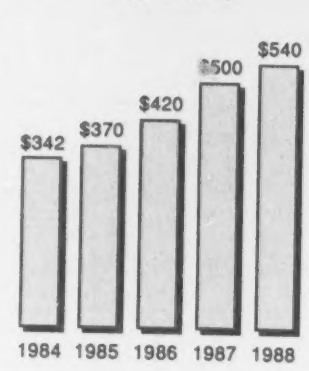
Hal Mayforth



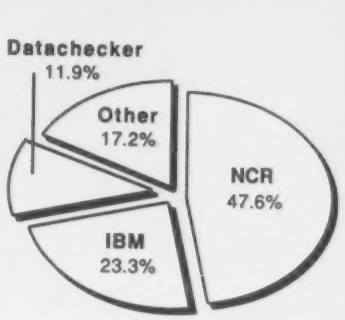
ing compatibility with IBM's proprietary Systems Network Architecture (SNA), in the retail market as it has in other arenas.

In January, NCR unveiled its next generation of POS terminals and high-end systems. The 7010, 7011 and 7032 systems, based on Motorola Inc.'s 68000 series of processors, can be configured with two processors which act as backup to one another in case either processor should fail. The result is a fault-tolerant system or what NCR calls continuous processors. In addition, NCR announced four interactive terminals and an IBM PC AT-compatible programmable terminal.

The U.S. POS terminals market



1986 vendor market share



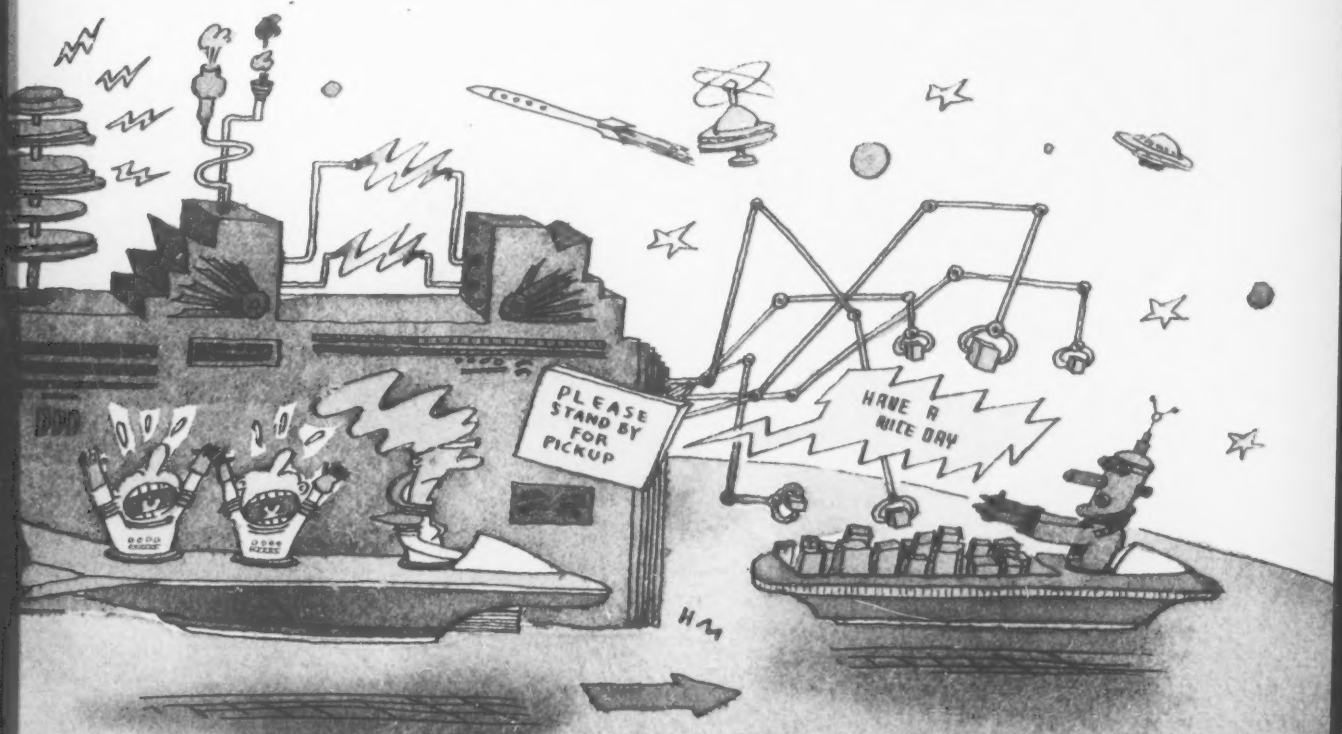
Source: International Data Corp.

Positioned to automate

NCR also brought out over 50 software programming tools and a set of application packages specific to users in mass merchandising, department stores and food stores. NCR's new high-end machines can run NCR's real-time Continuous Processing operating system (CP/OS) concurrently with Unix, the standard operating system developed by AT&T. That enables NCR customers to run any number of industry standard software applications, in addition to retail-oriented packages, says NCR's Steinmetz. "If they don't like our office automation package," says Steinmetz, "they can use someone else's." Because of NCR's open systems approach, says Steinmetz, "we stand positioned to automate the entire store."

In light of NCR's recent announcement, First Boston's Milunovich believes NCR has cemented its lead in the POS terminals market. "NCR is clearly the leader," says Milunovich. The company's new offerings, adds Milunovich, have "advanced functionality at the same price as IBM." Dataquest's Brown agrees. NCR's new generation of systems, says Brown, "created new price points." A retail store, says Brown, "can now get everything it needs [to automate] from NCR for under $25,000."

Providing the best solution to the customer is particularly important in



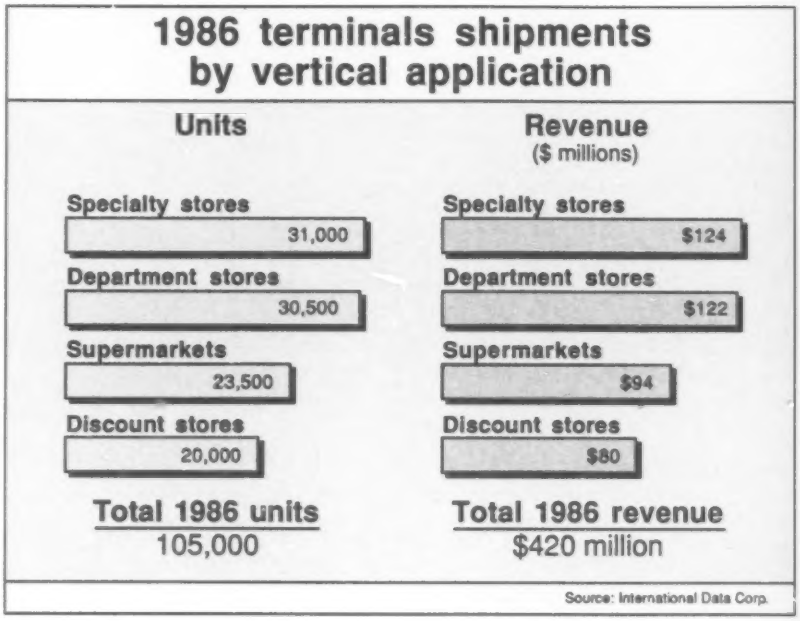
the retail market. The larger segments of the POS market — such as department and food stores — are saturated, says Peter A. Cohen, an analyst with IDC. "It is basically a replacement market," says Cohen. And while NCR has maintained its lead in the market, in part because of users' loyalty, retail customers replace POS equipment only every 12 years, says NCR's Steinmetz. If a customer is ready for the next generation of systems, and the vendor is not, it will be at least a decade before the vendor has a chance to sell to them again.

Smaller segments of the market, what IDC's Cohen calls "Mom and Pop" stores, are far from saturated, however. But many smaller, specialty stores use stand-alone electronic cash registers, made by Japanese manufacturers such as Casio Computer Company Ltd. and Sharp Corp. Total sales of stand-alone systems, says Cohen, are expected to grow 35% this year, to $688 million from $509 million. Sales of POS terminals like the machines made by IBM and NCR, however, have been recording a steady but modest 12% growth rate over the past five years.

In January, IBM announced enhancements to its System/36 operating system, SSP, which enables it to communicate with the company's POS terminals. Analysts agree, though, that NCR has little to worry about, even from the likes of IBM. If IBM's success in the POS terminals market has come at anyone's expense, it has cost Datachecker Systems Inc., the Santa Clara, Calif., subsidiary of National Semiconductor Corp. In January, Datachecker announced the company was closing its plant in Maynard, Mass., and laying off 250 manufacturing employees there. Larry Allman, Datachecker's executive vice president and general manager, says the company's sales have been flat for the past 18 months and he doesn't expect any improvement until the second half of this year.

But the company is making some changes this year that could bode well in the POS terminals market. Datachecker, like NCR, is concentrating more on software products than it has in the past. Over the past two years, says Allman, the company has been focusing on software research and development. Now, about 70% of its engineering staff are software writers. Last year, Datachecker was the first vendor to offer a 32-bit, AT-compatible system for stores. Datachecker has also offered fault-tolerance for the last three years on its proprietary minicomputer which acts as an in-store processor. "Our architecture is ahead of its time," says Allman.

ANNE KNOWLES



Eliminating "float" electronically

Today, it is difficult to remember life without automatic teller machines (ATMs). Initially, though, ATMs received a lukewarm reception from the consumer and acceptance was slow in coming. But once they took off, ATMs became ubiquitous.

The same thing may be happening with the concept of electronic fund transfers (EFTs), says NCR Corp.'s Carl J. Steinmetz, vice president of the company's retail systems division. In the case of EFTs, consumers can make purchases at retail stores that offer the service by using the same debit card used with ATMs. The price of the purchase is then automatically debited from the consumers bank account. While certain large companies, such as Mobil, have begun to offer the service and it has found popularity in certain regions, such as Florida, widespread acceptance of EFTs has yet to take place.

Consumer acceptance has been limited by the fact that EFTs are automatic. When a consumer writes a check, for example, the delay that occurs — between the day it is written and the day it is actually cashed — allows consumers to "float" funds. That float means the consumer can make a purchase whether money is in the bank account or not. Or the buyer can make interest on the money used to make a purchase during the delay between the day the check was written and the day the check is cashed.

But the problem with EFTs goes beyond consumer psychology. No one is sure who should pay for the service, says International Data Corp. analyst Peter A. Cohen. Retail stores benefit because of the high cost of bad checks. The banks benefit because EFTs are more automated than the check cashing process. And the consumer supposedly benefits by the convenience. But no one wants to pay for the service. "The banks think retailers should pay for it," says NCR's Steinmetz. "The retailers think the banks should pay for it. Ultimately," he adds, "the consumer will pay for it." □

The challenge to Microsoft in 386 operating systems

New players are emerging in operating systems due to the delay in fully optimized software for Intel's 80386

The whole personal computer industry may be talking about the new computers based on Intel's 32-bit 80386 chip, but to date no software exists to take full advantage of the chip's considerable power.

Despite the new computer chip's ability to handle several programs running at the same time and use massive amounts of memory for fancy graphics and number crunching, it is crippled by the lack of an adequate program — operating system software — to carry out those tasks fully. Redmond, Washington-based Microsoft Corp., which developed the operating system that has become a standard on IBM PC compatibles, has yet to release a version that can make the 80386-based personal computers reach their potential. Microsoft's competitors are taking advantage of this situation by trying to nip away at its dominant position as supplier of the systems.

One of the more frustrating problems for software applications developers is that current versions of the IBM PC's disk operating system (DOS) can only utilize 640 kilobytes of memory for applications. Software running on a computer with an 80386 chip, therefore, can only take advantage of a fraction of the 4 gigabytes that can be accessed by the microprocessor.

Operating-system software is the housekeeper of the computer. One of its main functions is to control a computer's abilities to store and retrieve information on disk drives and memory banks. It also manages certain routines inside the computer chip.

Current 80386 computers, such as COMPAQ Computer Corp.'s DeskPro 386, must use a Microsoft Corp. operating system designed for the 80386's relatively primitive predecessors, the Intel 8088 and 80286. That limits them to existing software applications that do not benefit from the 80386 except for an increase in execution speed.

Houston-based COMPAQ, IBM's closest rival in PCs, leapfrogged the computer giant's own standard when it announced and shipped the first 80386-based computer. Several other companies followed close behind COMPAQ. IBM, as of mid-January, had not announced its version based on the advanced chip.

Just as hardware companies have rushed their own 80386 computers into the vacuum left by IBM, software houses are taking advantage of Microsoft's lag by announcing their own operating systems or control programs that provide extra functionality on the 80386 computers.

The Software Link Inc., a small Atlanta-based software company, for example, hopes to gain acceptance for its own version of the 80386 operating system before Microsoft gets a 80386 version of DOS to the market. Software Link took the features of PC-DOS and upgraded them to take advantage of the new chip's capabilities. The company says that its PC-Modular Operating System/386 software can run several programs at once, support up to 25 other terminals linked to the host PC and allows applications to use large chunks of memory. The Software Link has been showing the program to developers since last October and it sent out copies of its operating-system program to 50 major software developers for technical review. The program will be available this winter.

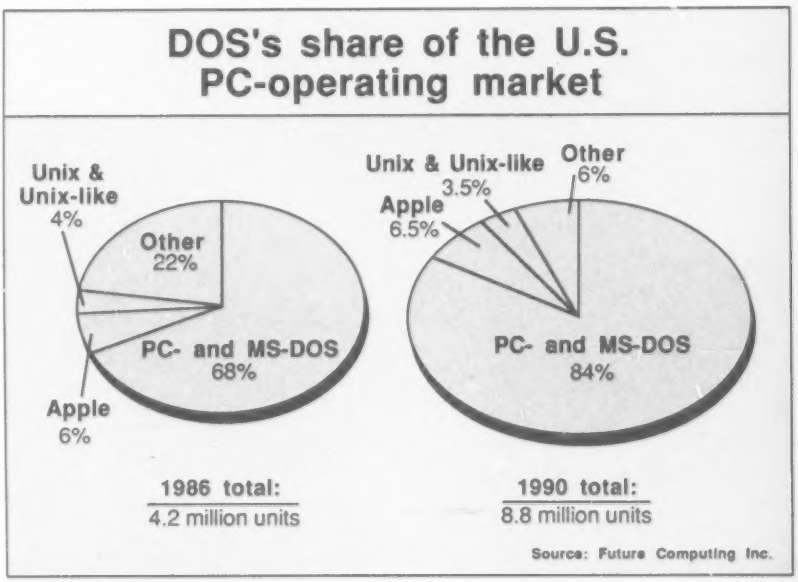
Other multitasking systems are also available that manage the 80386 in a way which simulates a number of standard IBM-compatibles within one computer. These so-called control programs permit the simultaneous running of more than one software application at a time. Several companies, such as Softguard Systems Inc., of Santa Clara, Calif., have already introduced such control programs.

Other operating systems, such as Pick and Unix are also likely to get a share, albeit small, of the 80386 market, says Meg Lewis, vice president of Dallas-based Future Computing Inc. "Some software that runs on DEC and other minicomputers will no doubt be written for the 80386 in Unix," she predicts.

But Lewis and others say it is likely that software applications developers will wait to see what Microsoft does before committing to an alternative system. Microsoft, however, has not announced when it will have an 80386 operating system, although consultants and analysts foresee it happening sometime in late 1987.

"There will be subsequent versions of DOS," concedes Adrian King, Microsoft's director of marketing for PC software. He would not be more specific except to say that it will support multitasking and use the power of the Intel 80286 and 80386 chips.

Meanwhile, COMPAQ claims that



. . . Stay Ahead

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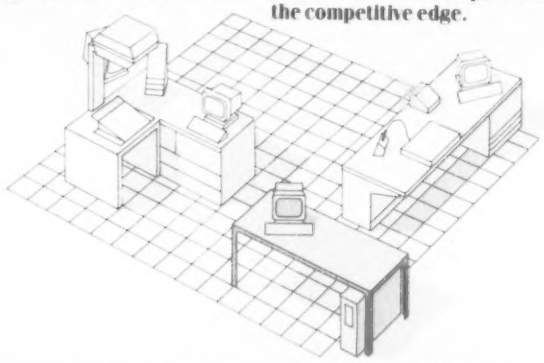

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the lack of a new operating system has not slowed down the DeskPro 386. The company claims that it sold more than 10,000 of the computers in the first three months since its introduction in September.

But consultants warn that sales could slow down soon. "Any new computer goes good out of the gate because power users buy it," says Alan Kucheck, a consultant for Novon Research Group of Berkeley, Calif. He added that new applications, which justify the expense and power of the 80386, will be needed to sustain that rate of sales.

Cautionary note

Andrew Seybold, president of the Seybold Group, a Torrance, Calif., consulting firm, is telling his clients not to buy 80386 computers right now because the next version of DOS has not arrived. He says that dealers are already discounting the DeskPro 386. "Given this state of affairs, we can't help thinking that it makes sense to be cautious," Seybold cautions. "Hold off on purchasing still another new-generation machine."

The Software Link, by virtue of being the first to the market with an 80386 operating system, says that it has a shot at wrenching control of the PC operating-software market from Microsoft. As Software Link's Gary Roberts, the company's director for sales and marketing, points out: "The best part is that we do have a product and Microsoft doesn't. We believe that right now we are in a very good position to get a foothold."

But overtaking Microsoft will not be easy. Microsoft, in partnership with IBM, developed the standard disk-operating system, PC-DOS, for the IBM personal computer. Microsoft also sells another version, MS-DOS, for IBM PC-compatible computers. To date, there is an estimated installed base of eight million PC-DOS and MS-DOS computers.

Moreover, Microsoft's King claims that Software Link's product really does not offer a new platform to build the next generation of applications on. "There is a whole infrastructure around DOS," he says. "An immense amount of software support is already out there in the form of debuggers, compilers, networking software and other tools." Microsoft, King says, will approach the next operating system from a different angle than the one Software Link is taking.

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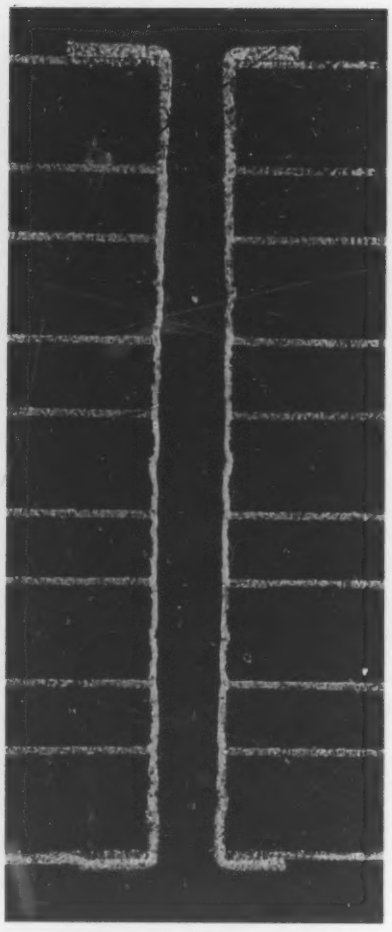

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will probably depend on IBM's move into the 80386 arena. Big Blue could develop a system that contains proprietary DOS functions, some analysts project. This would make the computer more functional within IBM's networks and also make it more difficult for other companies to copy.

"I'm convinced IBM is going to add its own enhancements to the 80386 chip," says Samuel Navarro, an analyst for Ladenburg, Thalmann & Company Inc., who is predicting a split in the IBM-compatible marketplace. "Either customers interested in staying within the IBM architecture of computer systems will buy an IBM, or those not interested will buy another machine."

ROBERT SNOWDEN JONES

Modem chips: The market starts to get crowded

Rockwell still dominates the modem microchip market, but here comes Fairchild, Intel and Silicon Systems

Despite recent reports, the modem market is not dead. Thanks to advancements in semiconductor technology, the number of modem applications is expanding and the major beneficiaries include both the traditional "modem in a box" manufacturers and the manufacturers of application-specific modem chips.

The increasing use of large and very large scale integrated (VLSI) chips and digital signal processors (DSPs) is causing modem chips to be made smaller, faster and cheaper. This trend, in turn, is bringing modem applications into areas such as pay telephones, credit card terminals and vending machines, to name a few. All of this is contributing to a U.S. modem market that is expected to grow from its current $978 million to about $2.4 billion by 1990, according to Timothy Bajarin, executive vice president at the research firm Creative Strategies International in San Jose, Calif.

But modems as we know them — black boxes that sit at the end of a telephone line to translate analog signals into digital signals and vice versa — are falling out of style. The future appears to be in integral modems: modems on a card, or on a single chip

Modem chips — a robust niche for semi manufacturers

U.S. consumption of ICs in modem equipment

	1985		1990	
Device type	Value ($ millions)	Market share	Value ($ millions)	Market share
MPU	$44.6	48%	$73.0	51%
Linear	20.5	22%	33.0	23%
Memory	15.8	17%	18.6	13%
Logic	12.0	13%	18.6	13%
Total	$92.9	100%	$143.2	100%
Implementation approach				
Standard	62.2	67%	71.6	50%
Semicustom	19.5	21%	43.0	30%
Custom	11.2	12%	28.6	20%
Total	$92.9	100%	$143.2	100%

Source: Gnostic Concepts

that can be plugged into a larger system such as a personal computer (PC). Indeed, modem chips built on a board or card represent less than 10% of today's market, says Bajarin. By 1991, however, he expects that number will jump to 70%.

As a result, a number of chip manufacturers that have an interest in the communications chip arena are hoping to expand their communications offerings by jumping into the modem chip arena — where U.S. consumption of integrated circuits (ICs) in communications products is forecast to grow from $3.45 billion at the end of 1987 to $6 billion by the end of 1990, according to Gnostic Concepts Inc., San Mateo, Calif.

Intel's foray

For Intel Corp., one of the newest hawkers of modem chips, the decision to offer a two-chip set of dedicated VLSI modem chips was a logical extension of the company's "commitment to microcommunications," says Mohan Passi, marketing manager for modems at Intel's Phoenix facility. Some industry analysts question Intel's venture into modem chips. The semiconductor manufacturer has already heavily invested in developing components for the eventual coming of a worldwide integrated digital services network (ISDN), which will eventually do away with the need for modems. Yet Edward Pullen, author of a Gnostic report on communication ICs, suggests that Intel's new venture makes a great deal of sense. Pullen expects modems will evolve into a communication interface unit within the ISDN network, and the modem-chip route is one way to get in on the ground floor of what is expected to become a very lucrative niche.

Another new entrant, Fairchild Semiconductor Corp., "has been working for years to get into the telecommunications market with functional-specific dedicated products," says Christopher Nehhan, communications products marketing manager at Fairchild's Analog Division, in Mountain View, Calif. The modem chip arena is Fairchild's second and most recent foray into the telecommunications arena. The company introduced a single-chip modem in November of 1985, and according to Nehhan, the product already has 80 design wins and 25 are currently in the production phase.

In the modem chip marketplace, one of the most successful players, and the oldest, has been Rockwell International Corp., which, according to a Gnostic report has an estimated 55% share of the market for chip-level modems. "Semiconductor companies have to migrate or evolve to become more communications oriented," says Marilyn Suey, director of marketing for Rockwell's Semiconductor Products Division in Newport Beach, Calif. Rockwell, Suey points out, "has one foot in semiconductors and one foot in communications, and is trying to meld the two."

The Japanese connection

In fact, Rockwell's success extends far beyond American shores. Several years ago Rockwell broke into the Japanese marketplace by making customized facsimile modem boards for both Matsushita Electric Works Ltd. and Ricoh Company Ltd. Today, according to Suey, Rockwell sells to "every major Japanese facsimile modem manufacturer." Suey also estimates that Rockwell has sold into Japan more than one million of its R96FAX facsimile boards — a product that began initial shipments in early 1985. Rockwell also sells high-speed device sets — 2,400 bits per second (bps) — and board-level products into Japan.

In the modem chip marketplace, one of the most successful players, and the oldest, has been Rockwell International

Another player that has made it through the doors of Japan's modem arena is Silicon Systems Inc. Silicon Systems recently inked a deal with Japan's Oki Electric Industry Company Ltd. Under a licensing agreement, Oki will manufacture and sell a number of Silicon Systems' modem chips. This makes the Tustin, Calif., firm the only player in the modem chip arena to have a second-source agreement with a Japanese firm, claims Carmelo J. Santoro, Silicon's chairman and chief executive.

This venture in Japan is not the firm's first, however. According to Santoro, $17 million, or 25% of his company's $67 million in 1986 revenue, came from Japan.

Fairchild, likewise, is hoping to extend its success in selling chips in Japan with its newly announced line of single chip modems. "We already have a number of design wins in Japan" for the company's 1,200bps single-chip modem, says Fairchild's Nehhan. These chips will either be built into PCs or PC accessories such as standalone modems or plug-in cards, which will then be imported into the United States.

Customer shifts

In addition to overseas opportunities, both modem component and modem-box manufacturers are finding new customer opportunities due to the growing trend away from standalone modems and toward the integration of modem capabilities into larger systems.

Within three short years, the customer base for application specific modem chips at ASIC manufacturer Silicon Systems has shifted from "third-tier companies making auto dialer parts . . . to *Fortune* 1000 customers, [including] AT&T and IBM," says Santoro.

At Rockwell, there has been a "significant increase in RFI's [requests for information]" coming from workstation and systems manufacturers, says Suey, who estimates that the current mix of RFIs is about three workstation and systems manufacturers to one traditional modem manufacturer.

Rather than hurting the traditional modem manufacturer, however, this trend seems to be benefiting them as well. Karl Zorzi, vice president of datacommunications products at Racal-Vadic, based in Milpitas, Calif., estimates that during calendar year 1986, approximately 12% of his company's business came from sales to original equipment manufacturers (OEMs). This compares with about 6% the previous year. He also expects his OEM business during 1987 to "go up at least half, if not double" that of last year.

This increase in sales to OEMs is also translating, on the other end, into increasing component purchases. During 1986, Zorzi estimates that Racal-Vadic, a subsidiary of Racal Electronics Ltd. in England, purchased "in excess of a quarter of a million chips," for modems, and he expects that during 1987 that number will increase to about 350,000. In addition to using proprietary components, Racal-Vadic also purchases chips from a variety of semiconductor vendors, including Rockwell, Intel, Silicon Systems, Sierra Semiconductor Corp. and Exar Corp.

CAROL SUBY

What's hot and what's not in workstations

CASE and electronic publishing are joining CAD/CAE as the high-growth segments of the U.S. workstation market

By David Card

Engineering workstations became a real live billion-dollar business last year. The fastest growing computer market held up in the face of an industry slump, and should continue to cruise along in 1987. High-growth industries tend to have common trends, and this one will be no exception. Prices will drop and market share will consolidate in the hands of a handful of players, while new applications, such as publishing and software engineering, will solidify.

Sales should reach $1.86 billion in 1987, forecasts market research firm International Data Corp. in Framingham, Mass. IDC analyst Vicki Brown says that unit sales are way up, but that the average selling price of a 32-bit, graphics-oriented, networked single-user computer (IDC's definition of a workstation) shriveled from $30,000 in 1985 to $22,000 last year.

Two key markets emerging this year are electronic publishing and software writing — usually referred to as CASE, for computer-aided software engineering. These applications do not need the high-performance color graphics required by design automation, which is still by far the biggest segment of the workstation market.

One of the big surprises of 1986, IDC's Brown also says, was the emergence of Hewlett-Packard Co. as the workstation leader, although other analysts, including Dataquest Inc. of San Jose, Calif., say Apollo Computer Inc. of Chelmsford, Mass., and Sun Microsystems Inc. of Mountain View, Calif., still dominate the market.

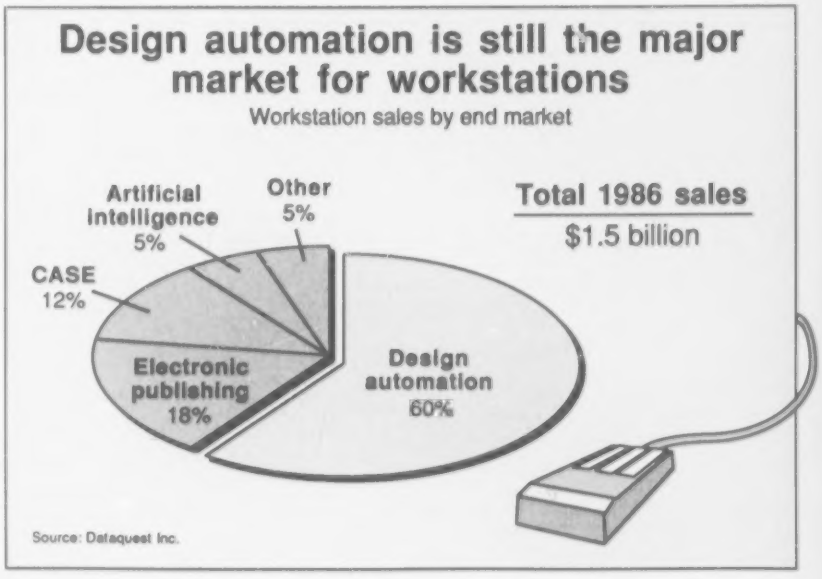
HP, which does not break out its workstation sales but agrees with IDC's conclusions, says its strength was not in selling to design engineering, the traditional destination for workstations. Instead, HP found new homes for workstations, on the factory floor and in the lab, as controllers for clusters of HP instruments. Measurement automation "is becoming a smaller proportion of our sales as other markets like design automation and software engineering come up," reports William Parzybok, vice president and general manager of HP's Engineering Systems Group in Fort Collins, Colo.

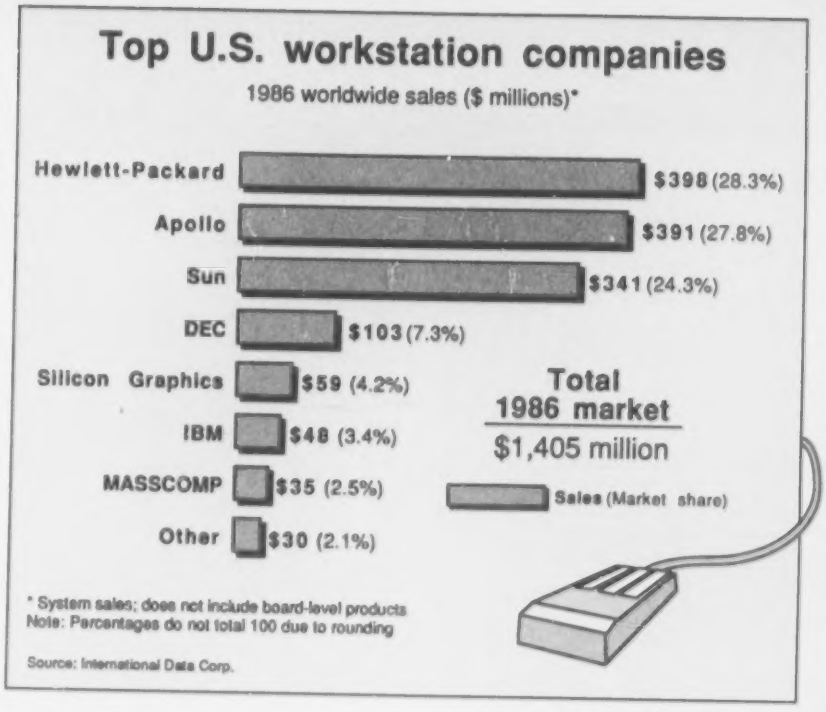
CASEs in point

For some analysts, however, including Dataquest, Sun is the undisputed leader in electronic publishing and CASE. Sun president Scott McNealy says that he sells CASE stations to what he calls "internal OEMs," rather than through regular original equipment manufacturers. "More often than not it's an EDS or a Boeing or a Lockheed or a Hughes or somebody like that who's got thousands of software engineers," he says.

"The other area is AI," McNealy says, referring to artificial intelligence. "It's not necessarily a market, but a technology that's probably going to drag us into a lot of weird markets that we wouldn't have gotten into."

Not surprisingly, McNealy is more excited about the design markets than Sun's current strongholds. Some of those internal OEMs have been using their Suns to write software for computer-aided design, manufacturing and engineering (CAD/CAM/CAE). The CAE and CAD markets have been a little sluggish lately, but will bounce back, McNealy says. "It comes in cycles, and maybe we're down at the bottom, but I see a lot of good development going on," McNealy says. "I haven't given up on it at all."





Anxious to add Sun to its list of original equipment manufacturing (OEM) suppliers is CAE/CAD vendor Racal-Redac Ltd. of Tewkesbury, England. The firm just signed a $25 million extension to its deal with Apollo. Redac also sells systems based on machines from IBM and Digital Equipment Corp. But Redac chief executive Ian Orrock likewise sees Sun as a powerful contender in Europe, Japan and Scandinavia, due to its OEM arrangements with major computer vendors in those regions. "Sun's greatest strength," Orrock adds, "is its software tools."

Apollo, however, late last year struck a blow into Sun's CASE heartland, landing a contract for some 130 workstations for the Software Productivity Consortium. The Consortium is a group of 14 defense contractors — including Allied-Signal Inc., Martin Marietta Corp., TRW Inc. and United Technologies Corp. — founded in September 1985 to streamline and regulate the process of writing software for military systems.

"Since it was not a government procurement, we were free to write a sensible RFP [request for proposal]," quips John Githens, vice president for the Consortium's Environmental Engineering division in Reston, Va. Githens likes Apollo because "they were not just a workstation and/or network vendor." He particularly likes the performance of Apollo's proprietary Domain network. But the Consortium would not have gone with Apollo if the company had not "opened up their network," with ties into networks and hardware from other suppliers.

He says that Apollo was "more forward-looking" and — surprise — more aggressive on pricing than Sun, usually regarded as the low-end leader. Githens says DEC also bid on the contract.

Publishing for dollars

Electronic publishing is also proving to be a boom market for workstations, accounting for 18% of 1986's sales, or $270 million, according to Dataquest. Two years ago, that share was only 13% for a $55 million total. Start-ups and established companies alike are rushing to offer software for the layout and design of publications, both for internal consumption and distribution [ELECTRONIC BUSINESS February 15, 1987]. Xerox Corp. was big enough to offer its own workstation as a publishing engine, with its proprietary microprocessor and operating system. But most workstation companies have rallied around the 68000 series of chips from Motorola Inc.

The rise of electronic publishing, meanwhile, has opened up new opportunities for third-party software companies and system integrators. Interleaf Inc. of Cambridge, Mass., for example, offers software for Apollo, DEC and IBM workstations as well as Sun. "Our decision proved right in hindsight," Interleaf marketing vice president George Potter says of opting out of the proprietary hardware business. "Apollo ships in a week what we ship in a year," he says, for example. This way Interleaf can concentrate on software development. At the same time, Interleaf competitor Texet Corp. of Arlington, Mass., last year switched from homemade hardware to Sun, says president Al Ireton, just in time to land a deal with typesetter supplier Compugraphic Corp., which was working on its own Sun-based system.

Another new market for workstations is financial analysis

Another new market for workstations, one with "the potential to be the biggest market in this industry," according to IDC's Brown, is financial analysis. "One of our largest single orders for workstations came from a non-engineering market, namely a large banking institution," says Richard Lewan, a marketing manager at DEC in Marlboro, Mass. Lewan says that the computing requirements of financial analysts — number-crunching on the desktop, multiple windows onscreen, tight networking — duplicate those of engineers. "You talk about these people moving billions of dollars around," he says. "They're not afraid to spend some money on a workstation."

The players

As the market matures, the hardware from the players in the workstation arena is getting more and more difficult to differentiate at a casual glance, according to Dataquest analyst David Burdick. Apollo used to be "The Proprietary One" and Sun, with its emphasis on the Unix operating system and Ethernet network, "The Standards One." Now, Apollo offers its version of Unix. HP always did. Standardization will not be a sales pitch in 1987 "because everybody's got it," predicts Edward Zander, Apollo's vice president for corporate marketing.

All three firms — Apollo, HP and Sun — use the 68020 chip from Motorola, but Parzybok hints that it would not be unreasonable to expect Hewlett-Packard to adopt its so-called Precision Architecture — based on proprietary reduced instruction set computing (RISC) chips. The 68030 is due early this summer, Burdick says, and its ready-made 68000 series software base will discourage the workstation companies from looking else-

where. The Intel Corp. 80386 is starting to ship, but the three leaders all claim disinterest.

Burdick of Dataquest also predicts that, as the machines become generic, marketing will be the distinguishing factor. Salesmanship will become increasingly important, he says.

Among the crowd, Silicon Graphics Inc. of Mountain View is "a company to look out for," according to Burdick. Silicon Graphics has staked out a cozy niche for itself at the highest end of the workstation market. The company sells 3-D graphics machines running $40,000 to $60,000 into markets such as mechanical CAE, animation and visual simulation. "At the high end, they are starting to be considered a mainstream application and architecture, and they are certainly recognized as the leader there," Burdick contends.

Dana Computers Inc. and Stellar Computer Inc. are two start-ups whose principals include famous names from Convergent Technologies Inc. and Apollo, respectively. Both firms profess to deliver by the end of the year ultra-high end graphics engines. Silicon Graphics director for product marketing Craig Olson says he thinks these two could price themselves out of his market.

"I don't see how they could possibly catch Silicon Graphics," IDC's Brown says. Olson adds that the "three key players," to his mind Apollo, DEC and Sun, are not competing in his market yet. His firm currently has an OEM deal with Control Data Corp.

Another new contender in the workstation world is MASSCOMP Corp. of Westford, Mass. "The primary difference between us and most of the others is that we supply product to people that sell workstations," according to Douglas Rowan, vice president for domestic sales and marketing. Harris Corp., and Unisys Corp.'s Graftek subsidiary, for instance. This was not always the case. Before MASSCOMP located its niche in real-time computing and data acquisition, it lost money trying to compete in the general purpose market.

In his business, Rowan says, he runs into DEC and HP as competitors. Right now, MASSCOMP is teaming up with Sun in competition for a 4,000-workstation contract to the National Security Agency, the U.S. hush-hush communications spy agency. Systems Development Corp., a Unisys systems integrator, is bidding the pair against Apollo, and another integrator is bidding IBM hardware, according to Rowan. He says that the NSA spec'd a two-part buy, with the general-purpose machine based on Apollo, and the real-time machine based on MASSCOMP. The winner is expected to be announced this month.

Four more to watch

Intergraph Corp., the Huntsville, Ala., CAD/CAM company, is known for picking smart hardware strategies — Intergraph was an early DEC OEM. So president James Meadlock did not exactly shock anyone when he steered Intergraph away from hosts to a distributed Unix workstation-based setup. But he did when he opted to build his own, especially with the Fairchild Semiconductor Corp.'s Clipper chip as its heart. "It doesn't make sense to run Unix on a DEC workstation," is Meadlock's reasoning.

> Smart money would not count either DEC or IBM out of the race

Now Intergraph is upping the voltage of its shock, with its January announcement that it is plunging wholeheartedly into the general-purpose workstation business. All of this mere months after denying any interest in the OEM market because of the "friction point" between OEMs and the systems suppliers that buy from them. Up until now, workstation sales, bundled with software, have been a little disappointing, Intergraph admits.

Prime Computer Inc. in Natick, Mass., is another CAD/CAM company, at least for a big part of its minicomputer business. Prime promised a workstation a year ago, but so far has not delivered. "It's got to be really hurting them," Brown says. Another minimaker, Data General Corp. of Westborough, Mass., has a strong CAD/CAM presence. "Compared to Apollo and Sun and even Digital, we're a little later getting into this market," admits director of product marketing John Scanlon. "But we have a strong customer base to build on."

The Macintosh personal computer from Apple Computer Inc. of Cupertino, Calif., is not a workstation by any means. However, the rumored second generation Mac will almost certainly contain the same Motorola chip powering most of the machines. Apple's vice president for new business developments, John Scull, will not comment on the subject, nor whether Apple will target workstation markets. But he does say "there is absolutely no question that the power of a workstation will move to the desktop."

Meanwhile, CAE market leader Mentor Graphics Corp. sells systems based on Apollo computers. Vice president Gerald Langeler is keeping a weather eye on Apple from his base in Beaverton, Ore. "It's going to be a very capable product," he says of the next Mac, "every bit as good as the '386 PC. And it may have some goodies that the '386 doesn't have. But it's not clear that they're going to make a big thrust" into CAE.

What's missing from this picture? DEC and IBM, that's what. "Both of these companies did surprisingly poorly," IDC's Brown contends. "The

problem DEC and IBM face is, are they going to eat their own children?" Burdick explains — meaning that newer machines could rapidly obsolete their current product line. He says that the two, as leaders in host-based computer systems, are having a hard time managing their way into distributed computing. Or even deciding if that is what they want to do.

In DEC's case, "surprisingly poorly" is a relative term at best. Both analysts count only complete workstations, that is, a computer with graphics. DEC has only offered a color graphics workstation for a year. It has sold at least 25,000 of its MicroVAX II board-level products, Burdick estimates. But he does not count those sales as workstations, because he says most customers are using the MicroVAX II as a three- or four-person mini-host. DEC fans will point out that any dollar spent on a MicroVAX II will not end up in the pockets of Apollo, HP or Sun.

Apollo admits as much. "In technical markets, DEC is the incumbent," Zander says. Besides a massive software base running under its VMS operating system (the MicroVAX can support it or DEC's version of Unix), Zander says DEC is perceived as a safer buy than the younger companies. "Where DEC will win — and they do win — against us, is in the corporate sell," Zander says.

DEC also has no shortage of OEMs. Nearly everyone who sells something that runs on any one workstation, also sells it on the MicroVAX. Smart money would not count either DEC or IBM out of the race.

And from the East . . .

Workstation vendors cannot help but give a glance now and then to the Far East. Nearly every Japanese computer company has announced some kind of a workstation, but few have arrived in the United States. Most follow the Motorola/Unix strategy.

To date, however, NEC Corp. is the only Japanese company to bring a workstation to the United States. NEC, which had been embroiled in a messy microprocessor patent infringement suit, stuck to a dual-Motorola chip design for its workstations. "We just wanted to stay in a standard architecture," says Frank Girard, vice president for systems marketing for NEC's American sales arm in Boxborough, Mass.

With a moving video-oriented product, NEC will focus on the automotive and aerospace industries, going after large companies with deep pockets, rather than trying to sign up OEMs, Girard says.

Meanwhile, Japan's Ministry of International Trade and Industry's Sigma project has started to produce workstations as well. And another state-sponsored effort is coming up with a Unix competitor called TRON. That is something way off, Sun's McNealy says. "Let's assume they get it done and they announce it," he says. "It's still going to take another seven or eight years to have it all ready. The industry, practically, is behind Unix. There is not a major company in the industry today that doesn't have Unix in its product line. TRON is going to be a while and there will be time to react." □

Whither Armonk?

IBM introduced its RT PC — for reduced instruction set computer (RISC) technology — in January 1986 with, for Armonk, no small fanfare. The RT, IBM's workstation, has so far proved something of a flop.

"It has clearly been a very, very big disappointment," says analyst David Burdick of Dataquest Inc., San Jose, Calif. He estimates only 3,000 to 5,000 were sold last year, concluding that the figure is closer to 3,000. "In technical markets you can't get too cute with not having leading-edge performance," Burdick contends. "It has a third to a fifth of the average floating point performance, no networking and clumsy graphics."

"It is not a technological barnburner," agrees Vicki Brown, an analyst with International Data Corp. (IDC) in Framingham, Mass. She expects IBM will correct most of the RT's performance deficiencies in early 1987. Still, without the software or original equipment manufacturers (OEMs) many expected to dog the RT, it will be 1988 before IBM has any significant effect on the market, Brown says.

Valid Logic Systems Inc., a San Jose computer-aided engineering (CAE) company, was one of the first to announce its intent to support the RT. Valid still has not offered an RT-based system. Marketing vice president David Foster runs some software on a proprietary workstation and some on Digital Equipment Corp.'s VAXstation.

"Once CV [Computervision] and others had a move to consider the RT. That has really fallen off," admits Bardwell Salmon, marketing vice president for Computervision Corp. in Bedford, Mass. CV is betting on a Sun workstation to power most of its computer-aided design/manufacturing (CAD/CAM) software. Likewise, Robert Lodi, marketing vice president for VIA Systems Inc. of Chelmsford, Mass., which sells CAD software for integrated circuit design on computers from Apollo, DEC and Sun is unimpressed. "The RT has no advantages in the engineering business," Lodi claims.

Apollo's Zander says that the RT's effect on his business has been negligible. "What a yawn. Everybody always tends to project doomsday scenarios from product announcements," he says. IBM, he thinks, may be "forgetting about our little dinky part of the business. What is it, even if it grows to $3 [billion], $4 billion, compared to the overall computer industry?"

Even though IBM may have sold more RTs than some of its other competitors suspect, DEC's Lewan says he's not worried either. Lewan claims that his customers have a performance "checklist" with minimum requirements for graphics, networking, power and price — none of which the RT meets.

"This will be the year to tell whether IBM will be a strong contender with the RT — whether it will be the RT or the '386," says Brown of IDC. She says that any potential workstation based on Intel Corp.'s 80386 chip would come out of a different division within IBM. The two would end up competitors. "It's not out of the question that IBM would drop it," she says of the losing product. Dataquest's Burdick agrees that this is the year to ask, "Is the RT part of the long-term equation?" He points out that at the end of the RT introduction last year, IBM quietly announced the discontinuation of its 9000 series.

IBM declined to be interviewed for this story. □

Can high tech make it in Massachusetts?

A poll of 1,099 executives, who work in Massachusetts, suggests all is not well in the land of the bean and cod

High-tech executives have strong opinions about what it is like to operate in one of the country's industry meccas — Boston's Route 128 area. And their opinions don't always agree with the prevailing political and economic beliefs.

A recent survey conducted by ELECTRONIC BUSINESS magazine revealed that managers in technology companies are most annoyed with politicians who take credit for the state's economic revival. They are also appalled by what they describe as the poor condition of the state's infrastructure — despite high taxes. In particular, many executives singled out recently reelected Governor Michael Dukakis, who is now gearing up for a run at the presidency.

Asked what was the most important factor limiting the growth of high tech in the state, a resounding 38% cited taxes. Many residents, indeed, cynically refer to the state as "Taxachusetts." The state has a 9.5% corporate tax on net income; a 5% tax on individual earnings; and a 10% tax on unearned income, such as interest and dividends.

On the positive side, however, nearly three out of four of the respondents thought the outlook for the high-tech economy in the state was either excellent or good. Many praised the state's academic institutions and "quality of life." Others indicated that they believe that Massachusetts will continue to shine as a center for innovation and research.

The ELECTRONIC BUSINESS survey was based on questionnaires mailed late last year to 4,000 executives at several hundred Massachusetts electronics companies, mostly smaller firms with annual revenue of between $5 million and $25 million — although executives at major corporations (such as Data General Corp., Digital Equipment Corp., General Electric Co., Prime Computer Inc. and Raytheon Co.) were also polled. Of the 4,000 executives selected from our circulation list, 1,099 responded, for a response rate of 27.5%. Those responding were not necessarily residents of Massachusetts. Some lived in neighboring New England states, primarily New Hampshire, and commuted to work in Massachusetts.

The survey revealed that managers in technology companies are most annoyed with politicians who take credit for the state's economic revival

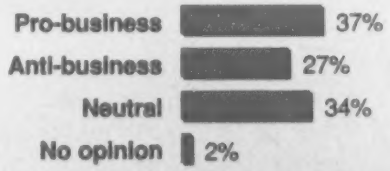
We believe the poll may be indicative of not only how small electronics companies rate the state, but of how Massachusetts businesses, in general, feel. A recent study by Massachusetts Institute of Technology's professor David Birch, for example, shows that of the 30,000 jobs that were created in Massachusetts in 1986 the great majority were in firms with fewer than 20 employees. And according to our 1,000 or so respondents, the problems most frequently cited by economists in a growth economy — shortage of labor and high wages — are nowhere near as important as other issues confronting small businesses in the electronics sector.

"Lower wage rates may influence a company's choice of location for manufacturing plants, but high-tech manufacturing is less and less labor intensive," wrote one engineering manager who, like many in the survey, asked not to be identified.

The respondents, however, were split on the effects of the state's low unemployment rate, which was 4.2% in November, and the reported shortage of labor. Some 47.6% of the respondents said their firms were having difficulty hiring; 47.7% said that they were not. When asked what kinds of jobs were most in demand, most of the respondents checked off engineering, production and marketing, in that order. But a number of other skills were also mentioned, including telemarketing help and machinists.

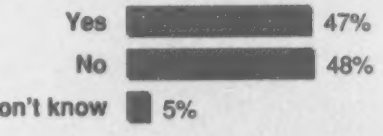
A big fear in Massachusetts — and indeed, in the United States — is that much of production manufacturing is migrating to low-wage areas of the world. When asked whether other states or countries with lower wage rates would be successful in luring the

In general, the government of Massachusetts is:



64% of those responding said the state government should take a more active role in fostering high tech; 3%, a less active role; 31% favored a hands-off policy; and 2% had no opinion.

Is your firm having difficulty hiring personnel?



42% of those responding said that they had difficulty filling engineering jobs; 20%, production jobs; 15%, marketing jobs; 10% clerical jobs; and 6% administrative jobs.

electronics industry away from Massachusetts over the next five years, 62.5% of the respondents said yes; 26.4%, said no.

Some noted an indirect effect of the state's high blue-collar wage rates. "Our company has seen two large customers relocate in South Carolina recently because union-backed demands for increased benefits and salaries jeopardized the companies' future," wrote the chairman of a small firm.

To some, however, the labor pool in Massachusetts was seen as a plus. When asked to name the single most important positive factor in fostering growth in the state's technology sector, one marketing manager indicated the "people," whom he described as "bright and well-educated."

Some respondents, however, said that finding certain types of skilled labor is a problem for their firms. "If the state leaves us alone," wrote the chairman of one company with what was a typical caveat, "the major future problem will be availability of non-professional labor and the inability to recruit professionals from outside of Massachusetts due to much higher real estate costs." As of October 1986, for example, the median sale price of a single-family home in Boston rose 19% to $165,600, compared with a national increase of 4.3% to $79,900.

However, "Massachusetts will remain a key R&D [research and development] area because of its university base and quality of life," argued David Wheeler, president of Intersell Inc., an electronic manufacturers' representative in Burlington, Mass. "Some production will always leave for lower wage rates."

Many respondents also said that the high cost of living in Massachusetts is a considerable factor in driving away production workers. "Manufacturing will move [out of the state] as the cost of living and housing makes manufacturing people less available," warned one vice president for manufacturing. "Real estate prices, congested traffic [and the] high-tax reputation make it almost impossible to hire a candidate from outside the Northeast, if the candidate is also considering another area of the country," added another marketing manager.

Respondents said that the high cost of living in Massachusetts is a considerable factor in driving away production workers

After the cost of living, apparently nothing so arouses the ire of high-tech executives as traffic and road congestion. Although the survey made no reference to either one, a number of respondents made a special point of mentioning the hassles of commuting to work on Boston's crowded roadways.

When asked to name the single most important factor limiting growth in Massachusetts, one vice president at a large company said laconically: "Poor infrastucture. And worsening roads, airport."

Others were more explicit: "The place is falling apart," wrote the chairman of one medium size firm. "Boston traffic must be fixed. Commuter rail must be run more often, by professionals, not union thieves. Highways need much more work, and a smart person to figure out how! Less politics, more action."

The cost of government also turned up fairly frequently as a complaint on our survey. One marketing manager cautioned that "the liberal politics and fiscal policies of the current administration will result in problems in the future. We are walking a fine line in terms of the overall state economy and employment. A misstep could result in a very bad fall."

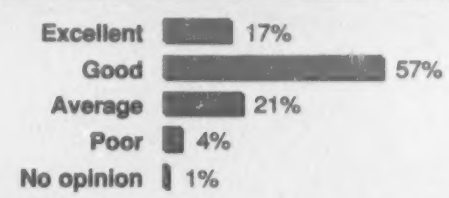
Added another executive: "Governor Dukakis has increased government expenditures excessively in the past four years. Should the state experience a slump, however temporary, the high level of expenditures and expectation created by them will again create an onerous tax environment in the state."

Others thought the Massachusetts government should be doing more to improve the climate for high-tech business. T. Cronin, president of Cronin Electronics Inc., a Needham, Mass., distributor, said the state should be "more active" in fostering high-tech industries — "but only if they understand and really believe [in it]." Dukakis, he added, "doesn't really believe and doesn't understand [business]."

Upbeat outlook

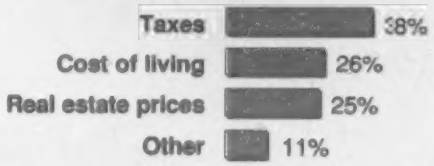
Some respondents were upbeat, however, about the state's government, citing the success of past programs as indicative of a positive future. "Our strong high-tech collegiate base, coupled with government assistance in establishing high-tech learning centers and industrial liaisons with both, should continue to foster increased growth in high tech," wrote David Krigman, manager of manufacturing technology at Lifeline Systems

The outlook for the high-tech economy in Massachusetts is:



Although a majority of respondents characterized the state economic outlook as either good or excellent, 63% predicted that lower wage states (or countries) would be successful in the next five years in luring high-tech industry away from Massachusetts.

What is the single most important factor in limiting high-tech growth in Massachusetts?



In the "other" category, respondents frequently cited traffic congestion, poor roads and a deteriorating state infrastructure.

Inc., a small manufacturer of emergency response systems in Watertown, Mass.

But most business people were skeptical of the state government's efforts to aid the high-tech industry. "The Massachusetts bureaucracy is one of the most inept I've ever encountered," wrote one marketing manager. "Dukakis should encourage more interaction and joint problem-solving efforts among business and academic institutions."

"Companies have to work around politicians trying to help them," said a vice president for engineering. Griped still another: "The blue collar/liberal orientation of Mass., government is contrary to high-tech growth." He cited "unionization, high taxes, high spending [and] cronyism."

Where credit is due

But no issue so infuriated respondents as their perception of politicians as opportunists who try to take credit for the state's economic revival. Most of the respondents, in fact, seemed to resent Michael Dukakis (D), who was re-elected in November by a whopping margin (72%) over George Kariotis (R).

"Governor Dukakis has done little to support high tech. The growth in the Mass., economy happened as a result of business initiatives and a stable federal government," wrote a vice president for engineering.

"When a state has a surplus of over $900 million after increasing its budget over 30%, the administration and legislature can no longer govern. They have been fiscally irresponsible and the business community pays," wrote Chris Alex, president and chief executive of Hybrid Packaging Tech Corp., Waltham, Mass., makers of thick-film hybrids for integrated circuits.

Another topic that drew heat was Proposition 2½, a popular state referendum that limited property taxes to two and a half percent of the assessed value of real estate. The referendum was backed by industry groups, which said that capping property taxes would help make Massachusetts industry more competitive. Dukakis, however, was castigated for his failure to support the measure.

> Respondents observed that the state's 200-plus colleges and universities had more to do with the state's economic success than political policy or lack of it

Proposition 2½, right-to-know [legislation], plant closing [legislation], etc. stamps him as antibusiness," said one marketing manager. Other criticisms were leveled at the attempts by Dukakis officials in previous years to levy a tax on software as a product.

Other respondents also observed that the state's 200-plus colleges and universities had more to do with the state's economic successes than political policy or lack of it. "High tech in Massachusetts was a spin-off of the universities and [MIT-affiliated] Lincoln Labs," wrote one marketing manager. "The state had nothing to do with the early years."

Still others credited industry groups for influencing state government. One chief executive of a large company said that the Massachusetts High Tech Council (a coalition of companies in the greater Boston area) "does more to foster high tech than does the state. It is a pity that state government views MHTC as an adversary, rather than an ally.

A few respondents were downright gloomy about the state's high-tech future. "High tech peaked in 1985 in Massachusetts," wrote the chairman of one company. "From this point on, [it's been] a long downward slide."

Some pinned Massachusetts' future to the computer industry. The "outlook for high tech may remain good if the computer industry rebounds," commented one Massachusetts marketing manager, "if not, you may see more layoffs and cutbacks in 1987. Competition in high tech is becoming stronger."

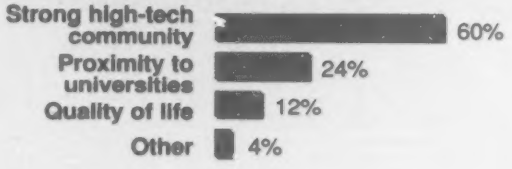
A Massachusetts-based securities analyst, who tracks the electronics industry, warned: "A shakeout in the high-tech industry could devastate the economy of Massachusetts in a manner similar to that brought on by oil price cuts in Texas."

But for every three gloomsayers, there was at least one bright commentator. Robert Ravenstein, for example, president of Bomara Associates, a software manufacturers' representative in Chelmsford, Mass., pointed out that Massachusetts may look good by comparison with other areas: "We are a sales office," he wrote. "Our principal companies are in California. Massachusetts is now the best source of revenue for these companies because of the slowdown in California."

THERESA ENGSTROM and
KATHLEEN E. HEPBURN

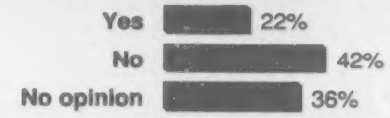
Engstrom is a Boston-based business writer. Hepburn is an assistant production editor at ELECTRONIC BUSINESS

What is the single most important factor in fostering high-tech growth in Massachusetts?



In the "other" category, numerous respondents cited the state's proximity to New Hampshire, which sports one of the most favorable tax climates in the nation.

Does the supposed "liberal orientation" of the state's congressional delegation affect the ability of local companies to win government contracts?



33% of those responding said Tip O'Neill's retirement as speaker of the house would make it more difficult for Massachusetts companies to win government contracts or influence high-tech policy in Washington; 46% said it wouldn't; and 21% had no opinion.